

**REMARKS**

Reconsideration and allowance of the subject application are respectfully requested. By this Amendment, claims 1, 2, 8, 27, 32, 34, 40, 41, 43, 53, 55, and 56 have been amended. Support, for any features not previously claimed, is found in the specification on page 102, line 25 through page 103, line 3. Claims 1-83 are all the claims pending in the application. Applicant respectfully submits that the pending claims define patentable subject matter.

**CLAIM REJECTIONS - 35 USC § 102**

Claims 1, 6, 8, 9, 12, 40 and 42-44 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Iwashita et al. (U.S. 2002/0149019). Applicant respectfully traverses the 35 U.S.C. § 102 rejection of the claims, as set forth below.

The following remarks are for independent claim 1 but apply by analogy, although not necessarily coextensively, to independent claims 8, 40, 41, and 43.

Amended claim 1 recites:

A method for manufacturing a piezoelectric device, the method comprising:

forming a bottom electrode on a substrate by an ion beam assist method, wherein by irradiating ion beams on the bottom electrode, said bottom electrode has a specific crystal orientation;

forming a piezoelectric film on top of said bottom electrode by an ion beam assist method, wherein by irradiating ion beams on the piezoelectric film, said piezoelectric film has a specific crystal orientation; and

forming a top electrode on top of said piezoelectric film.

The Examiner continues to maintain that "Iwashita clearly states that his 'upper electrode can be formed or grown by a laser ablation method...**with an ion beam assist.**' This is clearly

stated at page 8, paragraph [0125].” (Office Action, page 2)

In the Amendment filed May 15, 2006, Applicant submitted that the Examiner mistakenly thinks that the “ion ablation method with an ion beam assist” and the “ion beam assist method” are the same. However, the “ion ablation method with an ion beam assist” in Iwashita is for irradiating ion beams on the **targets** which are used in the sputtering process or the like. The “ion ablation method with an ion beam assist” causes the particles to lift from the targets, and subsequently, the particles accumulate on the substrate. Conversely, the “ion beam assist method” is for etching the layers (such as the bottom electrodes, piezoelectric film and ferroelectric film). These layers (such as the bottom electrodes, piezoelectric film and ferroelectric film) already have the target accumulated on their substrate, and as a result of the “ion beam assist method,” only a specific crystal orientation (such as a (100) orientation) is left.

In order to explain to the Examiner that the phrase “**with an ion beam assist**” in Iwashita does not mean “ion beam assist method,” Applicant herein submits a technical article titled, “Properties of WNx films and WNx/GaAs Schottky diodes prepared by ion beam assisted deposition technique,” J. Appl. Phys. Vol. 67, No. 2, 15 January 1990. In this technical article, similar to Iwashita, the phrase “ion beam assisted” appears but it means “ion beam assisted deposition technique” (see FIG. 1 and the second paragraph in the left column of page 1135 of J. Appl. Phys.), not “ion beam assist method.” In this technical article, (similar to Iwashita) an ion beam is irradiated on the target and not on the substrate obtain a specific crystal orientation. Indeed, the idea of obtaining some specific crystal orientation is not disclosed. In fact, neither Iwashita nor this technical article can provide a specific crystal orientation using the “ion beam

assist method”.

Conversely, an aspect of the present invention is provides a specific crystal orientation in the bottom electrode and the piezoelectric film, by the ion beam assist method in which an ion beam is directly irradiated on the substrate (the bottom electrode or the piezoelectric film).

Again, Iwashita’s disclosure in paragraph [0125] is “a laser ablation method ... with an ion beam assist” which means the particles lift from the targets and accumulate on the substrates by assisting (i.e., irradiating) ion beams on the targets. Based on the technical article and the arguments setforth herein, one skilled in the art would clearly understand that Iwashita discloses only the “ion ablation method with an ion beam assist” and not the “ion beam assist method.”

For at least the foregoing reasons, independent claim 1 and its dependent claim 6 are patentable over Iwashita. For similar reasons, independent claims 8, 40, and 43 are patentable over Iwashita, too, along with their respective dependent claims 9, 12, 42, and 44. Therefore, the 35 U.S.C. § 102 rejection of claims 1, 6, 8, 9, 12, 40, and 42-44 should be withdrawn.

### **CLAIM REJECTIONS - 35 USC § 103**

Applicant respectfully traverses the 35 U.S.C. § 103 rejection of the claims as set forth below.

#### **A. Claims 2-5 and 41**

Claims 2-5 and 41 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Iwashita et al. (U.S. 2002/0149019) in view of Sakamaki et al. (U.S. 6,255,762).

For similar reasons discussed above vis-à-vis claim 1, Iwashita fails to teach or suggest the subject matter of independent claims 2 and 41. Sakamaki, applied for its teaching regarding

a col coating, does not compensate for the deficiencies of Iwashita.

Even taken for what they would have meant to a skilled artisan, the individual or combined teachings of Iwashita and Sakamaki do not anticipate or render obvious independent claims 2 and 41. Therefore, the 35 U.S.C. § 103 rejection of claims 2-5 and 41 should be withdrawn.

*B. Claims 11, 32-35, 55 and 56*

Claims 11, 32-35, 55 and 56 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Iwashita et al. (U.S. 2002/0149019) in view of Nakahata et al. (U.S. 5,401,544).

For similar reasons discussed above vis-à-vis claim 1, Iwashita fails to teach or suggest the subject matter of independent claims 32, 34, 55, and 56. Nakahata, applied for its teaching regarding focused ion beam etching to form interdigital electrodes, does not compensate for the deficiencies of Iwashita.

Even taken for what they would have meant to a skilled artisan, the individual or combined teachings of Iwashita and Sakamaki do not anticipate or render obvious independent claims 32, 34, 55, and 56. Therefore, the 35 U.S.C. § 103 rejection of claims 11, 32-35, 55 and 56 should be withdrawn.

*C. Claims 7 and 10*

Claims 7 and 10 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Iwashita et al. (U.S. 2002/0149019) in view of Kashiwaya et al. (U.S. 2003/0175062).

As discussed above vis-à-vis base claims 1 and 8, Iwashita fails to teach or suggest the

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subject matter of claims 1 and 8. Kashiwaya, applied for its teaching regarding specific compounds, does not compensate for the deficiencies of Iwashita.

Even taken for what they would have meant to a skilled artisan, the individual or combined teachings of Iwashita and Kashiwaya do not anticipate or render obvious independent claims claims 1 and 8, much less dependent claims 7 and 10.

Further, regarding claims 7 and 10, the Examiner concedes that “The specific orientation is not noted. They do not employ the ion beam assist method for formation of layers.” (Office Action, page 6) Further, the Examiner maintains that the specific orientation of the material is a result effect variable.

However, Applicant submits that forming the layers to have a specific orientation is more than discovering an optimum value of a result effective variable that involves routine skill in the art, and the combined teachings of Iwashita and Kashiwaya fail to disclose the elements as set forth in the claims 7 and 10.

For at least the foregoing reasons, claims 7 and 10 are patentable over the combined teachings of Iwashita and Kashiwaya. Therefore, the 35 U.S.C. § 103 rejection of claims 7 and 10 should be withdrawn.

*D. Claims 13 and 45*

Claims 13 and 45 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Iwashita et al. (U.S. 2002/0149019).

As discussed above vis-à-vis base claims 8 and 43, Iwashita fails to teach or suggest the subject matter claimed therein. Therefore, dependent claims 13 and 45 are patentable by virtue

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of their dependency from claims 8 and 43, respectively.

Further, with regard to the specific orientations of the crystal, Applicant refers the Examiner to the remarks discussed above for claims 7 and 10. For at least the foregoing reasons, the 35 U.S.C. § 103 rejection of claims 13 and 45 should be withdrawn.

E. Claims 27 and 53

Claims 27 and 53 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hanabata (U.S. 6,478,412) in view of Nakanishi et al. (U.S. 6,229,250).

Amended claim 27 recites:

A method for manufacturing a piezoelectric device comprising the steps of:

forming a bottom electrode on a substrate;

forming a piezoelectric film on top of said bottom electrode by an ion beam assist method, wherein by irradiating ion beams on the piezoelectric film, said piezoelectric film has a specific crystal orientation; and

forming a top electrode on top of said piezoelectric film;

wherein said step of forming a bottom electrode comprises the steps of forming a first layer by an ion beam assist method whereby irradiating ion beams on the bottom electrode, said bottom electrode has a specific crystal orientation, and forming a second layer by continuing deposition with the ion beam assist stopped.

Amended claim 53 recites:

A method for manufacturing a ferroelectric device comprising the steps of:

forming a bottom electrode on a substrate;

forming a ferroelectric film on top of said bottom electrode by an ion beam assist method, wherein by irradiating ion beams on

the ferroelectric film, said ferroelectric film has a specific crystal orientation; and

forming a top electrode on top of said ferroelectric film;

wherein said step of forming a bottom electrode comprises the steps of forming a first layer with an in-plane orientation by an ion beam assist method, whereby irradiating ion beams on the bottom electrode, said bottom electrode has a specific crystal orientation and forming a second layer by continuing deposition with the ion beam assist stopped.

The Examiner concedes that Hanabata does not form the bottom electrode by forming a first layer by an ion beam assist method, and forming a second layer by continuing deposition with the ion beam assist stopped. The Examiner applied Nakanishi in an attempt to compensate for the deficiencies of Hanabata. However, Nakanishi (and Hanabata) fail to teach or suggest that the step of forming a bottom electrode comprises the steps of forming a first layer by an ion beam assist method.

Even assuming, *argendo*, that Nakanishi teaches forming an electrode, the method used in Nakanishi is for forming the entire electrode, and not for forming only a first layer of an electrode. Specifically, Nakanishi discloses that an electrode layer 13 consists of an amorphous layer, a crystalline layer, and an oxide layer, and that when forming the electrode layer 13, it will be formed separately into the amorphous layer and crystalline layer. That is, Nakanishi fails to teach or suggest that only the amorphous layer is formed with the method, but discloses that both the amorphous and crystalline layers are formed with the method.

Therefore, Nakanishi and Hanabata fail to teach or suggest that the step of forming a bottom electrode comprises the steps of forming a first layer by an ion beam assist method, as recited in the claims.

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For at least the foregoing reasons, claims 27 and 53 are not anticipated or rendered obvious by the individual or combined teachings of Hanabata and Nakanishi. Therefore, the 35 U.S.C. § 103 rejection of claims 27 and 53 should be withdrawn.

#### **ALLOWABLE SUBJECT MATTER**

The Examiner has allowed claims 26 and 52 over the applied prior art in their present form. Claim 28 stands objected to as being dependent upon a rejected base claim. Applicant has not rewritten claim 28 and believes that this Amendment should place this application in condition for allowance.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Date: September 13, 2006